

INFANT SITE ACOUSTIC SURVEY AND ASSESSMENT

YSGOL-YR-HAFOD EXTENSION, JOHNSTOWN

REPORT REFERENCE NO. J003355-5113-RDC-01

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This report has been prepared based upon a scope of works and associated resources agreed between the client and Philip Dunbavin Acoustics Ltd (PDA). This report has been prepared with all reasonable skill, care and diligence and has been based upon the interpretation of data collected. This has been accepted in good faith as being accurate and valid at the time of the collection. This report has been based solely on the specific design assumptions and criteria stated herein.



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1.0 SUMMARY

The acoustic specification for the proposed extension to Ysgol-yr-Hafod Primary School, Johnstown is given in accordance with the current issue of Building Bulletin 93 (Feb 2015) “Acoustic design of schools: performance standards”.

An ambient noise survey has been conducted to assess the acoustic climate in the vicinity of the proposed development. Noise levels at the proposed façade are such that the internal noise criteria of BB93 will likely be achievable using a natural ventilation strategy and purge ventilation / summer overheating ventilation may be provided by fully opened windows.

Performance standards in accordance with BB93 are given for internal unoccupied noise levels. For temporary 'portakabin' type accommodation the classrooms will be physically separate and provided with suitable internal finishes such that assessment of the internal sound insulation and reverberation times are not required.

Mechanical services noise limits are given in terms of internal noise levels in classrooms.

2.0 BRIEF FOR CONSULTANCY

PDA were engaged to carry out the following work:

A. Noise Survey - Infant site for temporary relocation of Juniors

We will travel to the site and carry out an ambient environmental noise survey to determine the environmental noise levels incident on the school buildings. The measurement and assessment will include for noise from the adjacent road network, and other local noise sources.

We would propose to undertake manned measurements during periods representative of the normal school day.

We will carry out all noise surveys in accordance with the provisions of BS7445 “Description and Measurement of Environmental Noise”. The measurements made will include both dBA and octave band noise levels including L_{eq} , L_1 , and L_{90} parameters.

B. Survey Processing and Report - Infant site for proposed temporary accommodation

The results of the noise survey will be assessed in line with the guidance of Building Bulletin 93 in order to inform the likely noise break-in to the proposed temporary classrooms and the glazing and ventilation strategy.

The results of our assessment will be presented in a short letter report. We have assumed that in this instance for temporary 'portakabin' type accommodation the classrooms will be physically separate and provided with suitable internal finishes such that assessment of the internal sound insulation and reverberation times are not required.

3.0 STANDARDS

Requirement E4 of Schedule 1 to the Building Regulations 2010 states;

1. *Each room or other space in a school building shall be designed and constructed in such a way that it has the acoustic conditions and the insulation against disturbance by noise appropriate to its intended use.*
2. *For the purposes of this Part – ‘school’ has the same meaning as in Section 4 of the Education Act 1996[4]; and ‘school building’ means any building forming a school or part of a school.*

Further to the above, the guidance contained within Section 0.12 of Approved Document E 2010 states;

In the Secretary of State's view the normal way of satisfying Requirement E4 will be to meet the values for sound insulation, reverberation time and indoor ambient noise which are given in Building Bulletin 93 Acoustic Design of Schools: performance standards, published by the Department for Education and available on the internet at www.gov.uk.

From the above statements it can be seen that compliance with the performance standards of Building Bulletin 93 (BB93) also ensures compliance with the acoustic requirements of the Building Regulations.

3.1 BB93 Acoustic Design of Schools: performance standards (February 2015)

A revised and updated version of BB93 was published in 2014 with the latest revision published in February 2015. BB93 gives standards for unoccupied ambient noise levels, sound insulation between spaces, and reverberation time for schools.

3.1.1 Indoor ambient noise level in unoccupied spaces

BB93 specifies the indoor ambient noise levels in unoccupied teaching spaces in terms of $L_{Aeq,30min}$ which is the 30-minute energy averaged sound pressure level within the unoccupied classroom. The limit applies to noise break-in from ambient noise external to the school and also noise from internal building services, but does not apply to noise generated by the operation of the school itself (i.e. noise from equipment, pupils and staff within or external to the building). A separate standard is given for new-build and refurbished rooms to permit existing rooms to be re-used where practicable without major refurbishment.

Table 1. BB93 specified unoccupied ambient noise levels

Room Type	Upper limit for indoor ambient noise level
	$L_{Aeq,30min}$ [dB]
Primary School Classrooms	35

The above noise levels are inclusive of any normal internal mechanical services and must be achieved where a space is mechanically ventilated. In the case where ventilation is provided by a natural or hybrid (natural with mechanical assistance) system, the above noise levels may be increased by 5dB during 'normal' ventilation rates of typically 5l/s/person (to limit the daily average carbon dioxide concentration to no more than 1,500ppm with the maximum concentration not exceeding 2,000ppm for more than 20 consecutive minutes on any day).

For summer cooling or purge / boost ventilation provided by natural means, which is under the control of the teacher, noise levels may be increased to no more than 55 dB. For fully mechanical systems boost or summer cooling must not exceed the values of Table 1 by more than 5 dB.

Automatic actuators for windows and vents etc. should not exceed the values of Table 1 by more than 5 dB to avoid causing disturbance.

3.1.2 Airborne Sound insulation between spaces and Reverberation Times

For temporary 'portakabin' type accommodation the classrooms will be physically separate and provided with suitable internal finishes such that assessment of the internal sound insulation and reverberation times are not required.

4.0 AMBIENT NOISE SURVEY



4.1 Site Description

The proposal is to install temporary classrooms on the school field of the existing infant school for pupils from the nearby junior school whilst refurbishment / extension works are carried out. The site is on a housing estate and the area immediately surrounding the site is residential.

4.2 Survey Times and Personnel

The survey was conducted on the 25th August 2021 between 10:08 and 14:38 hours. All measurements were made and partially attended by Dr Richard Cookson PhD, BSc(Hons), MIOA of PDA Ltd.

4.3 Equipment

The survey was conducted with an NTi XL2 sound level meter. The XL2 sound level meter is a Class 1 accuracy sound level meter in accordance with IEC 61672-1:2002 capable of operating as an integrating sound level meter with frequency analysis and statistical functions.

The sound level meter was set to measure both 'A' weighted sound pressure levels and octave band frequency spectra, using a 'fast' time weighting. Measurements were taken at a single measurement position at the location of the proposed façade of the new temporary classrooms on the school field of the existing school. The microphone was of the 'free field' type. The meter was field calibrated before and after the survey, during which time no significant calibration drift was observed.

4.4 Weather

During the course of the survey the weather was clear. The temperature was 16 – 20 ° C. Wind speeds varied between 0 and 1 m /s.

4.5 Measurement Positions & Procedure

Measurements were made at a single measurement position at the location of the proposed façade of the new temporary classrooms on the school field of the existing school off Melyd Avenue, Johnstown.



Figure 1. Survey measurement location

The microphone was mounted 1.5m above ground and at least 3.5m from any other reflecting surface. A range of statistical noise indicators were measured, including octave band L_{Aeq} , L_{A90} and L_{A1} .

Definitions of the above terms are listed below:

- L_{Aeq} : The equivalent A-weighted noise level containing the same energy within the measured time period.
- L_{A90} : This is a statistical parameter that is equivalent to the noise level that is exceeded 90% of the measurement period.
- L_{A1} : This is a statistical parameter that is equivalent to the noise level that is exceeded 1% of the measurement period.

4.6 Results

The measured 'A' weighted broadband sound pressure levels are presented in terms of L_{Aeq} , L_{A90} and L_{A1} below. The levels presented in the Table have been rounded to the nearest decibel. Full data is presented at the end of this report.

Table 2 – Summary of Results

Maximum $L_{Aeq,30min}$ [dB]	L_{A90} [dB]	L_{A1} [dB]
55	37 - 49	47 - 62

4.7 Discussion of external noise levels

BB93 states that for single sided natural ventilation the internal criteria can normally be achieved where the external noise levels do not exceed the internal noise criterion by more than 16 dB, and for cross ventilated or roof ventilated buildings the internal criteria can normally be achieved where the external noise levels do not exceed the internal noise criterion by more than 20dB.

In this case, for natural ventilation, the internal noise criterion in the most sensitive classrooms is 40 dB(A) [35 dB(A) + 5]. This suggests that the internal criterion will be achievable using single sided natural ventilation as the external noise level is not greater than 56 dB(A) [40 dB(A) + 16].

With regards to L_{A1} BB93 states that: “In order to protect students from regular discrete noise events, e.g. aircraft or trains, indoor ambient noise levels should not exceed 60 dB L_{A1, 30mins}”. The maximum external L_{A1} levels was measured as 62 dB. In PDA’s experience the difference between external levels and internal levels within classrooms when the windows are open for ventilation is around 15 dB, so in this case we would expect the maximum internal L_{A1} to be around 47 dB and hence this would comfortably meet the required 60 dB internal criterion with open windows.

For summer cooling or purge ventilation provided by natural means under control of the teacher the internal level should not exceed 55 dB. As the external noise level does not exceed 55 dB this will be comfortably achievable using fully opened windows as required.

5.0 MECHANICAL SERVICES NOISE

Noise levels from any mechanical services in classrooms should not exceed the unoccupied ambient noise criteria of BB93 [35 dB(A) in classrooms]. For intermittent boost or summertime cooling ventilation under the control of the teacher, mechanical services noise may increase by 5 dB [40 dB(A) in classrooms] for the duration of the boost operation.

6.0 DISCUSSION

The results of the environmental noise survey indicate that the site is suitable for natural ventilation and that internal noise criteria are likely to be met using this ventilation strategy. Further to this fully open windows for summer cooling or purge ventilation under control of the teacher will not exceed the internal noise criteria of BB93.

For temporary 'portakabin' type accommodation the classrooms will be physically separate and provided with suitable internal finishes such that assessment of the internal sound insulation and reverberation times are not required.

7.0 CONCLUSION

The acoustic specification for the proposed extension to Ysgol-yr-Hafod Primary School, Johnstown is given in accordance with the current issue of Building Bulletin 93 (Feb 2015) “Acoustic design of schools: performance standards”.

An ambient noise survey has been conducted to assess the acoustic climate in the vicinity of the proposed development. Noise levels at the proposed façade are such that the internal noise criteria of BB93 will likely be achievable using a natural ventilation strategy and purge ventilation / summer overheating ventilation may be provided by fully opened windows.

Performance standards in accordance with BB93 are given for internal unoccupied noise levels. For temporary 'portakabin' type accommodation the classrooms will be physically separate and provided with suitable internal finishes such that assessment of the internal sound insulation and reverberation times are not required.

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APPENDIX A – FULL SURVEY RESULTS

Date	Time	L _{Aeq}	L _{A1}	L _{A90}	Notes
25/08/2021	10:08	50.3	56.1	41.6	
25/08/2021	10:38	55.3	61.5	48.6	Noise from adjacent garden
25/08/2021	11:08	46.9	56.4	42.2	
25/08/2021	11:38	45.1	52.8	41.5	
25/08/2021	12:08	44.2	53.2	40.9	
25/08/2021	12:38	43.9	51.5	39.9	
25/08/2021	13:08	40.9	47.8	37.1	
25/08/2021	13:38	39.6	47	36.5	
25/08/2021	14:08	45.9	56.8	38.4	

APPENDIX B – DEFINITION OF ACOUSTIC TERMS

The decibel

This is the basic unit of noise, denoted dB.

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB L_{Aeq} . Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq(s)}$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq} . It can also be expressed in terms of frequency analysis (see later). $L_{eq(s)}$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB L_{An} . It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}

This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) L_{max} , dB L_{Amax} , etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq} , L_{90} , L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.